ASPECTS OF FINITE ELEMENT STRATEGIES FOR LARGE DEFORMATION PROBLEMS ON MOVING MESHES

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This work is concerned with some aspects of finite element modelling of large deformation problems on moving meshes. The Lagrangian and Arbitrary Lagrangian-Eulerian (ALE) finite element methodologies are employed in order to accommodate large deformations of computational domain [1-5]. An important requirement for a number of applications in this area is accurate modelling of interface behaviour that may include presence of the surface tension phenomena [2,3]. This work briefly discusses some basic aspects of the underlying finite element methodology in the Lagrangian and ALE description. Aspects of computational modelling of interface behaviour are also described, including a finite element formulation of a surface tension model.

When the problem geometry experiences significant changes throughout the deformation, the mesh moving approaches suffer from excessive mesh distortion due to often very large particle displacement, and requires frequent remeshings during the simulation. The need for remeshing is further emphasised in the presence of possible topological changes due to separation and merging of free surfaces and interfaces. Apart from the expense, remeshings may also degrade the accuracy of the computation due to frequent transfer of relevant variables between different meshes. This work briefly describes some important issues related to an adaptive strategy developed earlier in the context of finite element deformations of inelastic solids at finite strains [4].

The features of the described computational strategy are illustrated on a range of numerical examples, arising in diverse areas of computational mechanics, including solid and fluid mechanics and fluid-structure interaction problems.

References

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